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CHROMOSOME NUMBERS IN THE COMPOSITAE. V.
MEXICAN AND GUATEMALAN SPECIES[1]

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The present study is based on bud material collected by Beaman and Rock during the summer of 1959 incidental to their separate studies on certain elements of the flora of Mexico and Guatemala.

Chromosome counts were made by Turner from pollen mother cell squashes as outlined by Turner and Ellison (1960). The voucher specimens collected by Beaman (Table 1) are deposited in the Michigan State University Herbarium; those collected by Rock are deposited in the University of Texas and Vanderbilt University Herbaria. The taxonomic identifications are those of the authors, except where otherwise noted. Table 1 should be consulted for a complete tabulation of the species studied, as some are not included in the discussion.

DISCUSSION

EUPATORIEAE — *Eupatorium glabratum* (n=17), *E. scorodonioides* (n=17). These counts are consistent with those previously reported for taxa of the section Eximbricata (Turner, Ellison and King, 1961).

Eupatorium pazcuarense (n=25). Both apomictic and sexual species are known for this genus; the present meiotic figures were normal with 25 bivalents. Chromosomally the species is related to those taxa on a base of x=10. *E. prunelaefolium* (n=50 univalents) is apparently apomictic, the meiotic chromosomes showing complete absence of pairing.

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Ageratum corymbosum (n=20). This species was also reported as a tetraploid by Turner, Ellison & King (1961).

Stevia (n=34 univalents). The count agrees with those obtained for several other Mexican species (Turner, unpublished), except that the latter have been completely regular at meiosis, showing 17 bivalents.

ASTEREAE — *Astranthium guatemalense* (n=9). The present count was also determined by Beaman and Stoutamire (unpublished) from the same bud collections. *A. guatemalense* is very restricted, occurring, so far as known, only in the Sierra de los Cuchumatanes.

Astranthium xanthocomoides (n=8). As indicated below, some species of *Astranthium* show a polyploid series on a base of x=4. This series apparently extends from the diploid to the hexaploid level. In this connection it is interesting to note that *A. guatemalense* (see above) is diploid with n=9; Stoutamire and Beaman (1960) and the present authors have reported n=18 for *A. mexicanum*. Further study, both morphological and cytological, is needed to determine if the apparent chromosomal base of x=9 for the latter two species has any phyletic significance. This information would seem particularly significant in view of the controversy concerning the probable ancestral basic number for the tribe Astereae (Turner, Ellison and King, 1961).

Astranthium sp. (n=12). This material probably represents an undescribed species. It is apparently hexaploid on a base of x=4, since the lowest diploid number reported for the genus is n=4 for *A. integrifolium* (Baldwin, 1941; Beaman, unpublished).

Erigeron (x=9). The chromosome numbers for the 4 species listed in Table 1 are consistent with the previous base numbers reported for other species in the genus. *E. pubescens* (n=36 univalents) is apparently apomictic. *E. scaposus* (n=18) is tetraploid showing 18 bivalents at meiosis I.

Figs. 1-25. Camera lucida drawings of meiotic chromosomes, all approximately × 1300. Fig. 1, *Eupatorium glabratum* (n=17). Fig. 2. *E. prunellaefolium* (n=50 univalents). Fig. 3. *Stevia* sp. (n=34 univalents). Fig. 4. *Astranthium xanthocomoides* (n=8). Fig 5. *Astranthium* sp. (n=12). Fig. 6. *Erigeron pubescens* (n= 36 univalents). Fig. 7. *Erigeron* sp. (n=36). Fig. 8. *Grindelia oxylepis* (n=6). Fig. 9. *Machaeranthera tanacetifolia* (n=4). Fig. 10. *Bidens angustissima* (n=10).

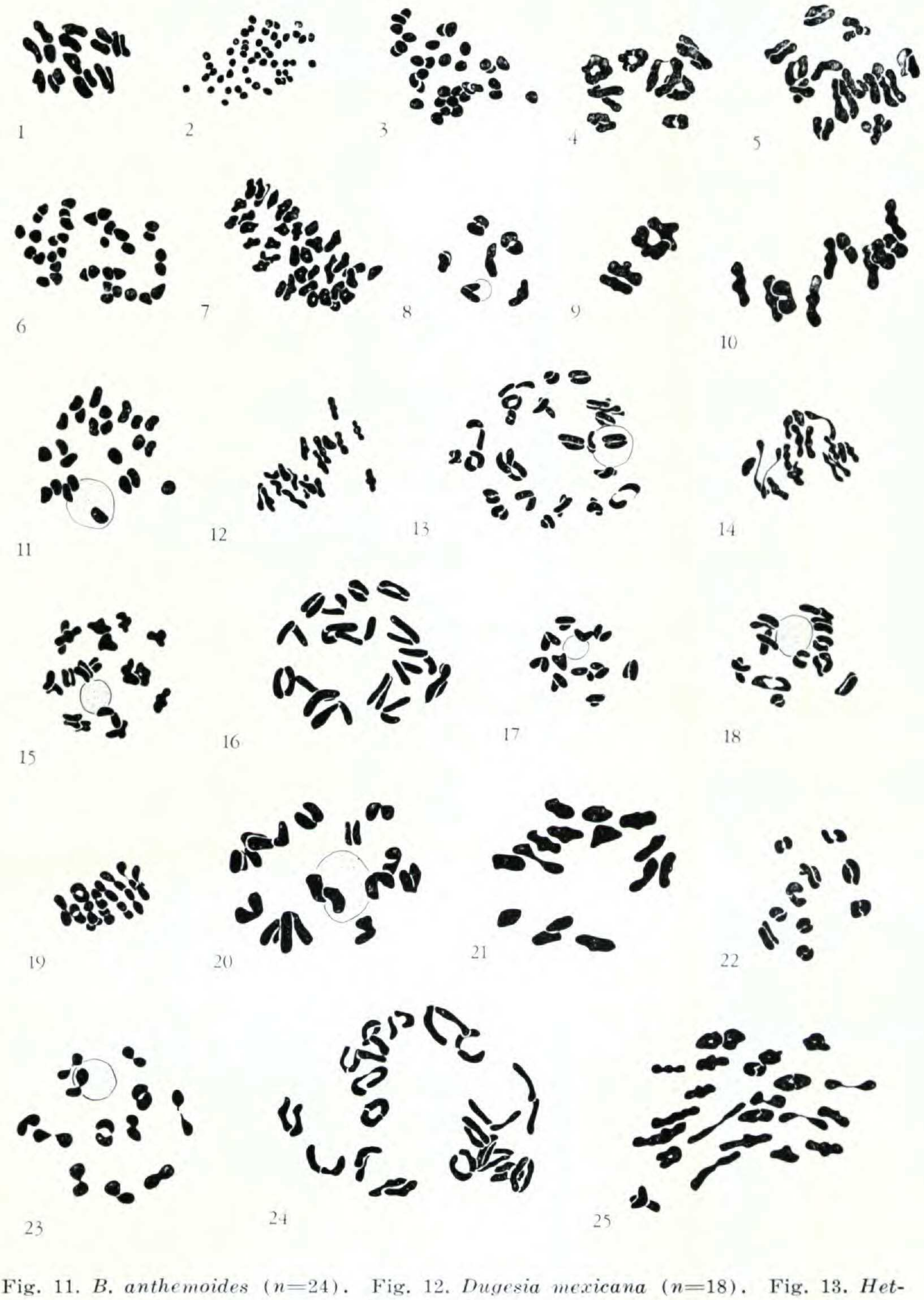

Fig. 11. *B. anthemoides* (*n*=24). Fig. 12. *Dugesia mexicana* (*n*=18). Fig. 13. *Heterospermum pinnatum* (*n*=25). Fig. 14. *Verbesina hypomalaca* (*n*=16). Fig. 15. *V. serrata* (*n*=17). Fig. 16. *Zaluzania coulteri* (*n*=16). Fig. 17. *Zinnia angustifolia* (*n*=11). Fig. 18. *Bahia xylopoda* (*n*=11). Fig. 19. *Dyssodia pinnata* (*n*=13). Fig. 20. *Hymenoxys insignis* (*n*=15). Fig. 21. *H. odorata* (*n*=15). Fig. 22. *Nicolletia edwardsii* (*n*=10). Fig. 23. *Porophyllum amplexicaule* (*n*=12). Fig. 24. *Senecio toluccanus* (*n*=20). Fig. 25. *Senecio* cf. *cyclophyllus* (*n*=23).

Erigeron sp. (n=9). This collection, *Beaman 2698*, is apparently an undescribed species. *Erigeron* sp. *(Beaman 2693*, n=36) is likewise an undescribed species and is octoploid, there being 36 bivalents at Meiosis I.

Chromosome numbers for the genera *Gutierrezia* (n=4) and *Grindelia* (n=6) agree with the basic numbers established for these genera by other workers. Determination of a voucher specimen of *Gutierrezia glutinosa* was made by Dr. O. Solbrig. The count for *Chaetopappa* is a first report.

Machaeranthera gymnocephala (n=4). Jackson (1959) reported this species to be diploid with n=5; however, his New Mexican collection is apparently referable to *M. blephariphylla* (Gray) Shinners since Cronquist and Keck (1957) would recognize the latter as a valid taxon. It is a distinct perennial of the southwestern United States and adjacent Mexico. *M. gymnocephala* is a biennial (or annual?) or weak perennial of more southern distribution. If Jackson's count applies to *M. blephariphylla* (n=5) the present chromosome count for *M. gymnocephala* (n=4) lends support to the recognition of it as a separate species.

HELIANTHEAE — *Bidens angustissima* var. *linifolia* (n=10). This is the lowest chromosome number reported for the genus to date. Previous counts have all been on a base of x=12 or 11 (Turner, Ellison and King, 1961).

Verbesina hypomalaca (n=16). Turner, Ellison and King (1961) have reported counts of n=17 and 18 for this genus. Apparently *Verbesina (sens. lat.)* is multibasic with x=18, 17, 16.

Zaluzania coulteri (n=16). The species identification is tentative. Previous chromosome counts for the genus have been on a base of x=18 (Turner and Johnston, 1961).

Chromosome counts for *Cosmos*, *Perymenium*, *Sanvitalia*, *Viguiera* and *Zinnia* are consistent with basic numbers already established for these genera (Turner, Ellison and King, 1961).

Chromosome counts for the genera *Dugesia* (n=18) and *Heterospermum* (n=25) have not been previously reported.

HELENIEAE — *Dyssodia pinnata* (n=13). This count agrees with a number of unpublished counts for the species

(Johnston and Turner, unpublished).

Hymenoxys odorata (n=15). Chromosome counts of n=11 have been reported by previous workers for *H. odorata* (Speece and Baldwin, 1952; Raven, unpublished); identification of the material from which the present count was made was verified by Dr. K. Parker.

Nicolletia edwardsii (n=10). Raven & Kyhos (unpublished) have also found counts of n=10 for the genus.

Chromosome counts for the genera *Bahia*, *Baileya*, *Porophyllum*, *Psilostrophe* and *Tagetes* are consistent with the basic numbers already established for these genera (Darlington and Wylie, 1956; Towner, 1958; Turner, Ellison & King, 1961).

ANTHEMIDEAE — *Achillea lanulosa* (n=18). The species, as represented in Mexico, is similar morphologically to other collections from North America and has the same chromosome number.

SENECIONEAE — The chromosome counts for *Senecio toluccanus* (n=20) and *S. sanguisorbae* (n=ca. 30) are consistent with counts reported for other species of the genus.

Senecio cf. *cyclophyllus* (n=23). Darlington and Wylie (1956) list one other species, *S. resedifolius*, from Siberia on a base of x=23. Both species belong to the section Aurei (Greenman, 1903, 1907).

SUMMARY

Chromosome counts are reported for 47 taxa of Mexican Compositae. These include first reports for 34 species, some of which belong to previously unreported genera (*Chaetopappa*, n=9; *Dugesia*, n=18; *Heterospermum*, n=25; *Nicolletia*, n=10; and *Stevia*, n=17).

Astranthium, as presently understood, has been found to have species with n=4, 8, 9, 12 and 18. *Machaeranthera gymnocephala* was found to be diploid with n=4, instead of n=5 as reported by a different investigator. Exceptional counts for the genera *Bidens* (n=10), *Melampodium* (n=11) and *Verbesina* (n=16) are also recorded.

Hymenoxys odorata, reported as n=11 or $2n$=22 by previous workers, was found to have Mexican populations with n=15. A count of n=23 for a Mexican species of *Senecio* was also obtained; the only other counts of n=23 for this genus have been from a Siberian species.

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TABLE 1. Summary of collections studied

Species	Locality	*n* chromosome number
EUPATORIEAE		
Ageratum corymbosum Zucc.	SAN LUIS POTOSI: La Capilla. (S. W. of San Luis Potosi) *Rock 456.*	20
Eupatorium glabratum H. B. K.	HIDALGO: *ca.* 1 km. north of Real del Monte, *ca.* 2770 m. alt. *Beaman 2370.*	17 (fig. 1)
Eupatorium pazcuarense H. B. K.	GUATEMALA: Dept. of Huehuetenango; Sierra de los Cuchumatanes, between kms. 324 and 325 on Ruta Nacional 9 N. (between Chemal and San Juan Ixcoy); *ca.* 3140 m. alt. *Beaman 3033.*	25
Eupatorium prunellaefolium H. B. K.	STATE OF MEXICO: at Puerto del Aire on Mexico-Puebla highway, 3196 m. alt. *Beaman 2903.*	50 all univalents (fig. 2)
Eupatorium scorodonioides Gray	SAN LUIS POTOSI: La Capilla. (S. W. of San Luis Potosi) *Rock 457.*	17
Stevia sp.	STATE OF MEXICO: Llano Grande. *Rock 352.*	34 all univalents (fig. 3)
ASTEREAE		
Astranthium guatemalense Blake	GUATEMALA: Dept. of Huehuetenango; Sierra de los Cuchumatanes, between kms. 324 and 325 on Ruta Nacional 9 N. (between Chemal and San Juan Ixcoy), *ca.* 3140 m. alt. *Beaman 3027.*	9
Astranthium mexicanum (Gray) Larsen	TLAXCALA: Llano Grande. *Rock 353.*	18
Astranthium purpurascens (Rob.) Larsen	HIDALGO: 6.7. mi. south of Jacala. *Rock 310.*	8
Astranthium xanthocomoides (Less.) Larsen	NUEVO LEON: *ca.* 26 mi. northeast of Dr. Arroyo on west side of mtn. known locally as Picacho Onofre, *ca.* 3230 m. alt. *Beaman 2697.*	8
Astranthium xanthocomoides (Less.) Larsen	HIDALGO: ridge *ca.* 2 kms. south of Real del Monte, *ca.* 2880 m. alt. *Beaman 2737.*	8 (fig. 4)

Astranthium sp.	NUEVO LEON: top of Cerro Potosi, *ca.* 3650 m. alt. *Beaman 2661.*	12	(fig. 5)
Chaetopappa bellioides Gray	NUEVO LEON: near Monterrey. *Rock 495.*	9	
Erigeron pubescens H. B. K.	HIDALGO: ridge *ca.* 2 kms. south of Real del Monte, *ca.* 2880 m. alt. *Beaman 2733.*	36 univalents (rarely a few bivalents).	(fig. 6)
Erigeron scaposus DC.	HIDALGO: ridge *ca.* 5 kms. northeast of Pachuca; *ca.* 2640 m. alt. *Beaman 2758.*	18	
Erigeron sp.	NUEVO LEON: *ca.* 26 mi. northeast of Dr. Arroyo on west side of mtn. known locally as Picacho Onofre, *ca.* 3300 m. alt. *Beaman 2698.*	9	
Erigeron sp.	NUEVO LEON: *ca.* 26 mi. northeast of Dr. Arroyo on west side of mtn. known locally as Picacho Onofre, *ca.* 2700 m. alt. *Beaman 2693.*	36	(fig. 7)
Grindelia oxylepis var. *eligulata* Steyermark	NUEVO LEON: 41.2 mi. south of Saltillo. *Rock 271.*	6	(fig. 8)
Gutierrezia glutinosa (Schauer) Sch. Bip.	NUEVO LEON: *ca.* 8 mi. east of Galeana on road to Linares, *ca.* 1850 m. alt. *Beaman 2679.*	4	
Machaeranthera tanacetifolia (H. B. K.) Nees	NUEVO LEON: 41.2 mi. south of Saltillo. *Rock 263.*	4	(fig. 9)
Machaeranthera gymnocephala (DC.) Shinners	SAN LUIS POTOSI: La Capilla. (S. W. of San Luis Potosi). *Rock 451.*	4	
HELIANTHEAE			
Bidens angustissima var. *linifolia* (Sch. Bip. ex Klatt) Sherff	HIDALGO: ridge *ca.* 5 kms. northeast of Pachuca, *ca.* 2640 m. alt. *Beaman 2763.*	10	(fig. 10)
Bidens anthemoides (DC.) Sherff	VERACRUZ: Cofre de Perote. *Rock 391.*	24	(fig. 11)
Cosmos diversifolius Otto in Knowles & Westc.	HIDALGO: ridge *ca.* 2 kms. south of Real del Monte, *ca* 2880 m. alt. *Beaman 2741.*	12	
Dugesia mexicana Gray	HIDALGO: ridge *ca.* 2 kms. south of Real del Monte, *ca.* 2770 m. alt. *Beaman 2756.*	18	(fig. 12)
Heterospermum pinnatum Cav.	SAN LUIS POTOSI: La Capilla (S. W. of San Luis Potosi). *Rock 463.*	25	(fig. 13)

Melampodium montanum Benth.	GUATEMALA: Dept. of Huehuetenango; Sierra de los Cuchumatanes, between kms. 324 and 325 on Ruta Nacional 9 N. (between Chemal and San Juan Ixcoy), *ca.* 3140 m. alt. *Beaman 3043.*	11
Perymenium mendezii DC.	HIDALGO: ridge *ca.* 5 kms. northeast of Pachuca, *ca.* 2640 m. alt. *Beaman 2764.*	15
Sanvitalia ocymoides DC.	QUERETARO: 4.7 mi. north of Queretaro. *Rock 435.*	16
Sanvitalia procumbens L.	HIDALGO: 6.7 mi. south of Jacala. *Rock 305.*	8
Verbesina hypomalaca Rob. & Greenm.	HIDALGO: ridge *ca.* 2 kms. south of Real del Monte, *ca.* 2880 m. alt. *Beaman 2742.*	16 (fig. 14)
Verbesina serrata Cav.	QUERETARO: 4.7 mi. north of Queretaro. *Rock 431.*	17 (fig. 15)
Viguiera stenoloba (Gray) Blake	COAHUILA: Canon de Tule, *ca.* 34 Saltillo. *Rock 239.*	
Zaluzania coulteri Hemsl.	HIDALGO: ridge *ca.* 2 kms. south of Real del Monte, *ca.* 2880 m. alt. *Beaman 2743.*	16 (fig. 16)
Zinnia angustifolia H. B. K.	SAN LUIS POTOSI: La Capilla (S. W. of San Luis Potosi). *Rock 449.*	11 (fig. 17)
HELENIEAE		
Bahia absinthifolia Benth.	DURANGO: 43.6 mi. northeast of Durango. *Rock 475.*	12
Bahia xylopoda Greenm.	HIDALGO: ridge *ca.* 5 kms. north of Pachuca, *ca.* 2640 m. alt. *Beaman 2762.*	11 (fig. 18)
Baileya pleniradiata Harv. & Gray	COAHUILA: Paila. *Rock 482.*	16
Dyssodia pinnata Rob.	NUEVO LEON: *ca.* 8 mi. east of Galeana on road to Linares, *ca.* 1850 m. alt. *Beaman 2680.*	13 (fig. 19)
Hymenoxys insignis (Gray) Cockerell	NUEVO LEON: top of Cerro Potosi, *ca.* 3650 m. alt. *Beaman 2649.*	15 (fig. 20)
Hymenoxys odorata DC.	NUEVO LEON: 41.2 mi. south of Saltillo. *Rock 264.*	15 (fig. 21)
Nicolletia edwardsii Gray	COAHUILA: Paila. *Rock 481.*	10 (fig. 22)
Porophyllum amplexicaule Engelm.	COAHUILA: Saltillo. *Rock 251.*	12 (fig. 23)
Psilostrophe gnaphaloides DC.	COAHUILA: Saltillo. *Rock 252.*	16

Tagetes lucida Cav.	HIDALGO: ridge *ca.* 5 kms. northeast of Pachuca, *ca.* 2640 m. alt. *Beaman 2761.*	11
ANTHEMIDEAE		
Achillea lanulosa Nutt.	STATE OF MEXICO: at Puerto del Aire on Mexico-Puebla highway, 3196 m. alt. *Beaman 2901.*	18
SENECIONEAE		
Senecio sanguisorbae DC.	NUEVO LEON: top of Cerro Potosi, *ca.* 3650 m. alt. *Beaman 2638.*	*ca.* 30
Senecio toluccanus DC.	NUEVO LEON: *ca.* 26 mi. northeast of Dr. Arroyo on west side of mtn. known locally as Picacho Onofre, *ca.* 2700 m. alt. *Beaman 2688.*	20 (fig. 24)
Senecio cf. *cyclophyllus* Greenm.	TLAXCALA: Llano Grande. *Rock 354.*	23 (fig. 25)

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